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HARVESTING, STORING, AND PACKING APPLES FOR THE FRESH MARKET: REGIONAL PRACTICES AND COSTS

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ABSTRACT

Methods of procurement, operating costs, and marketing practices of 232 firms packing fresh apples in the 1969/70 season are delineated for five major production regions. Most apples came from the firms' own acreage or were handled on a consignment basis. Harvesting costs per bushel--including costs of picking and hauling the apples to the packing shed or to storage--ranged from 34 cents in the Northwest to 44 cents in the Northeast. Regular atmosphere and controlled atmosphere storage charges were lowest in California and the Lake States and highest in the Northwest. Packing costs--including labor, container, selling, and overhead costs--ranged from 94 cents for bulk cartons in the Lake States to \$1.58 per tray-pack carton in the Northwest. Sales direct to chainstores were the most common, accounting for 35 percent of total sales of all firms. Sales to wholesale terminal firms accounted for 21 percent of total sales, and sales to chainstores through brokers, for 19 percent. The most common term of sale was f.o.b. shipping point, especially in the Northwest.

Key Words: Apples; Costs; Fresh Fruit; Fresh Market; Harvesting; Interregional Competition; Marketing; Packing; Selling; Storage.

PREFACE

The objective of the research project "An Interregional Activity Analysis For Apples With Intertemporal Extensions," is to generate information to assist the apple industry in making efficient adjustments in response to economic and technological changes in the apple marketing system. This report is a part of that project. Previous reports were:

Regional Costs of Harvesting, Storing, and Packing Apples, by Joseph C. Podany and Robert W. Bohall, ERS-496, reprinted from the Marketing and Transportation Situation, Nov. 1971.

The Retail Demand for Fresh Apples, by Victor G. Edman, Marketing Research Report No. 952, Apr. 1972.

Analysis of Apple Prices and Price Spreads, by Alfred J. Burns and Robert W. Bohall, ERS-511, reprinted from the Fruit Situation, Nov. 1972.

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SUMMARY

Methods of procurement, marketing practices, and costs of harvesting, storing, and packing fresh apples vary widely among the five major apple production regions of the United States, according to a survey covering the 1969/70 marketing year.

Of the 232 grower-packer and packing firms surveyed, those in the Northwest, Appalachia, and California areas obtained the bulk of their fresh apples from their own acreage. Consignment was the predominant procurement method in the Lake States and the Northwest. Overall, nearly 34 percent of the firms' fresh apples came from their own acreage, 30 percent was received on consignment, and 24 percent came from member-growers of cooperatives.

Harvesting costs (picking and hauling costs) ranged from an average of 34 cents per bushel in the Northwest to 44 cents in the Northeast. Domestic migrant labor harvested 71 percent of the apples in Appalachia and 90 percent in the Lake States. Local labor was most important in California and the Northwest, although domestic migrants also harvested a considerable share of the apples in these regions.

Storage charges ranged from 23 cents per bushel for regular cold storage in California to 75 cents for controlled atmosphere storage in the Wenatchee-Okanogan, Wash., area of the Northwest. Controlled atmosphere storage, which slows the respiration rate of the fruit, has become increasingly important in extending the fresh apple marketing season into the summer months. In 1972, about half the apples stored went into controlled atmosphere storage, compared with 4 percent in 1957.

Packing sheds in the Northwest handled the most apples, both in terms of average hourly output--371 cartons--and seasonal volume--325,314 cartons. Although the Northeast firms had the least hourly output--120 cartons--their packing season was the longest. Hence, their seasonal volume--130,050 cartons--was larger than that in the Lake States, Appalachia, and California.

Average labor costs per packed container were lowest in the Lake States (32 cents) and the Northeast (35 cents) and highest in Appalachia (44 cents) and the Northwest (46 cents). Differences were partially influenced by the percentage of apples packed in trays instead of in bags and bulk cartons and by the quality of the fruit packed.

Container costs for tray packs, bag cartons, and bulk cartons were generally highest in Appalachia, California, and the Northwest. Selling costs averaged 26 cents per container in the Northeast and 18 cents or less in the other regions. Overhead costs exceeded 30 cents per container in California and the Northwest, but averaged 20 cents or less in the other regions.

Free-on-board shipping point and delivered were the two predominant terms of sale. Over 90 percent of the apples packed by the Northwest firms were sold on an f.o.b. basis. Chainstores were the most common sales outlet. For all five regions combined, 35 percent of the volume went to chainstores directly and 19 percent was sold to chains through brokers.

Most sample firms sold the bulk of their fresh apples within their own region or in adjacent consumption areas, with the California firms selling nearly 86 percent of their fresh apples within the State. However, apples packed by the Northwest firms were marketed in 10 consumption regions, with 20 percent going to California, and five other consumption regions each receiving 9 to 14 percent.

Estimates of returns to grower-packers for tree-run apples indicate that returns are higher when apples are stored in controlled atmosphere storage instead of in regular atmosphere storage. Returns on Red Delicious apples of similar quality and size and packed in similar containers were about equal for all regions producing this apple variety.

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HARVESTING, STORING, AND PACKING APPLES FOR THE
FRESH MARKET: REGIONAL PRACTICES AND COSTS

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INTRODUCTION

There are five major apple production regions in the United States. In each region, production for the fresh market consists of different proportions of various varieties, grades, and sizes of apples. Harvesting, storing, and packing practices vary according to means of procurement, picking labor used, length of the storage season, type of storage, quantity of apples stored, type of containers packed, terms of sale, types of buyers, and the geographic markets served. The picture is further complicated by differing cost structures for harvesting, storing, packing, and transporting fresh apples to market. Since survival in the fresh apple industry depends on all these factors, each packer and shipper is vitally concerned with the relative efficiency of his operation and with the competitive position of his region.

Apple growers are interested in factors that influence their returns between the time apples are harvested and the time they are sold. The concern of growers, packers, and shippers was especially evident during the three marketing seasons 1969/70 through 1971/72, which were characterized by high production levels and depressed prices for both fresh apples and apples for processing. The 1969/70 crop, which was the largest on record, exceeded 160 million bushels, including over 88 million bushels marketed for fresh consumption.

Consumers are also interested in the costs involved in producing and marketing apples through to the retail store. Consumers have frequently asked why apples cost more at the retail store than at the orchard.

This study was designed to obtain information on regional marketing practices, technology, and costs of harvesting, storing, and packing fresh apples. The objective is threefold: (1) to provide information that will allow managers to compare their costs and returns with those of local competitors and those of firms in other production regions; (2) to provide data on technological coefficients and marketing costs that could be used in overall studies of the apple industry; and (3) to provide benchmark information on marketing practices, costs, and margins for fresh apples.

1/ Joseph C. Podany and Robert W. Bohall are agricultural economists, and Joan Pearrow is a statistical assistant, Commodity Economics Division, Economic Research Service.

SURVEY PROCEDURE

Commercial apple production is reported by the U. S. Department of Agriculture's Statistical Reporting Service for 34 States. For purposes of this study, five main production regions were defined. The regions, which represented 24 States and 97 percent of the reported commercial fresh apples having value in 1969, were as follows: (1) Northeast (New York, New Jersey, and New England); (2) Lakes States (Michigan, Ohio, Indiana, Illinois, and Wisconsin); (3) Appalachia (Pennsylvania, West Virginia, Delaware, Maryland, Virginia, and North Carolina); (4) California; and (5) Northwest (Washington, Oregon, Idaho, and Colorado).

For each region, lists of grower-packers and packers and their estimated annual volume were compiled from industry and trade sources. All firms handling 500,000 bushels or more in the Northwest and those handling 200,000 bushels or more in the other regions were personally contacted. Firms handling 100,000 to 500,000 bushels in the Northwest and those handling 100,000 to 200,000 bushels in the other regions were sampled at rates varying from 25 to 100 percent, depending on the concentration of firms in each region. 2/

Information on harvesting, storing, and packing costs and charges was obtained through personal interviews with managers of each sample firm. Data were obtained in the summer of 1970 for the 1969/70 marketing year. A total of 232 firms out of a possible 286 provided information for the survey as follows: In the Northeast region--33 firms; Appalachia--61 firms; Lake States--33 firms; Northwest--89 firms; and California--16 firms.

The study examines the marketing practices of the firms and the costs incurred in removing apples from the tree through loading the packed fruit in railcars or trucks for shipment to consuming centers. Operations include procurement, picking, hauling, storing, grading, sizing, packing, selling and loading for shipment to consumption centers. The exact sequence of operations varies by time periods within the marketing year, by apple variety, by production area, and by individual firms. For example, apples may (1) not be stored but go directly to the packing shed; (2) be stored tree-run directly after picking; (3) be stored after preliminary grading and sizing, or (4) be stored after being packed in shipping containers.

The Appalachia and California regions were, where possible, each subdivided into two areas, and the Northwest region was subdivided into three areas. All data represent weighted averages. 3/ Harvesting costs and storage charges are weighted by the total volume of fresh apples handled by each firm. Labor and overhead costs are weighted by the total volume of apples packed for the fresh market. Container costs are weighted by the total volume of fresh apples packed in each type of container. Selling charges are weighted by the total volume of packed fresh apples sold.

2/ For a more detailed discussion of the sample selection, see the appendix to this report.

3/ Weighting factors: (1) Total volume of fresh apples handled represents volume of tree-run physically handled by packer and intended for the fresh market. Includes packed fruit plus utilities and cullage but excludes any fruit

FRESH APPLE PROCUREMENT

Generally, most of the apples packed by the firms came from the firms' own acreage, were received on consignment, or came from member-growers of cooperatives or grower-stockholders of corporations (table 1). Direct purchases from growers and other packers were less important sources.

Of the 232 sample firms, 137 had acreage of their own. Eighty-one of these firms used its own acreage almost exclusively, with each firm obtaining more than 75 percent of its apples from owned acreage. This procurement method was especially important in Appalachia, the Northeast, and California. Nationally, it was the supply source for 34 percent of the fresh apples handled by the sample firms. Packers with their own acreage have an assured source of fruit through outright ownership or control. Similarly, growers doing their own packing are guaranteed an outlet that will handle and pack their apples.

For packers in the Lake States and in the Northwest, consignment was the predominant method of procuring fresh apples, but it was used sparingly in Appalachia and California. Nationally, one out of three of the sample firms handled some fresh apples on a consignment basis, and 54 firms used consignment for half or more of their supplies. Packers working on a consignment basis perform the services of packing and selling the fruit and charge a fee for their services. Another similar operation is custom packing, except that the selling function is usually handled by the grower.

Forty-six of the apple packing firms in the survey were cooperative organizations or grower corporations--they were most important in the Northwest. In total, nearly one-fourth of the fresh apples were handled by such organizations. Eighteen of the firms handled some fruit of nonmember growers, but volume was generally small.

Ninety-five packers, or 40 percent of the sample firms, had some form of oral agreement or written contract with growers prior to harvest. As indicated in the tabulation on page 5, such agreements were most common in the Northwest and California regions.

3/ (cont.) going straight from the orchard to processors. (2) Total volume of apples packed for fresh market represents total volume of apples actually packed by the firm for fresh market but excludes utilities and culls. Also excludes any additional fruit where the firm only acts as a broker or sales agent. (3) Total volume of apples packed in each container represents total volume of apples packed in tray-pack containers, in bag cartons, in bulk cartons, and so forth; (4) Total volume of packed fresh apples sold includes total volume of fresh apples packed and sold by the firm, plus total volume of packed fruit sold for others as a sales agent or broker.

Table 1--Sources of fresh apples, sample packing firms, five major production regions, 1969/70

Region	Own acreage		Cooperatives or corporations		Member growers		Nonmember growers		Outright purchase	Custom packing	Consignment	Other packers	Total			
	Percent of volume	Number of firms	Percent of volume	Number of firms	Percent of volume	Number of firms	Percent of volume	Number of firms	Percent of volume	Number of firms	Percent of volume	Number of firms	Percent of volume	Number of firms		
Northeast	49.2	26	3.5	3	0.4	2	14.9	13	8.6	7	22.3	11	1.1	2	100.0	33
Lake States	28.4	16	12.8	7	.8	4	3.7	8	.1	1	53.8	17	.4	1	100.0	33
Appalachia	64.3	41	19.0	9	2.2	5	4.5	6	5.8	7	4.0	6	.2	1	100.0	61
Northwest	20.3	42	32.4	25	.9	7	2.8	9	4.3	7	38.3	45	1.0	2	100.0	89
California	59.9	12	14.4	2	0	0	21.2	7	4.5	4	0	0	0	0	100.0	16
Average	33.9	137	24.1	46	1.0	18	5.3	43	4.5	26	30.5	79	.7	6	100.0	232
Number of firms 1/																
Northeast	26	3	2	13	7	11	2	33								
Lake States	16	7	4	8	1	17	1	33								
Appalachia	41	9	5	6	7	6	1	61								
Northwest	42	25	7	9	7	45	2	89								
California	12	2	0	7	4	0	0	16								
Total	137	46	18	43	26	79	6	232								

1/ Some of the sample firms obtained apples from more than one source.

Region	Firms with contracts	
	Number	Percent
Northeast.....	9	27
Lake States...	5	15
Appalachia...	16	26
Northwest.....	55	62
California....	10	62
Total.....	95	40

Contracts usually specify the varieties, volume, sizes, and quality of fruit to be delivered to packers. Other terms such as price and timing of deliveries are sometimes added.

Several of the contracts and oral agreements included provisions for payment to growers before harvest and extension of credit for purchasing supplies and hiring of production and harvesting labor (table 2). In addition, many firms also provided orchard supervision and advice on cultural practices, spray programs, and when to harvest. Packers in the Northwest and California were by far the most active in providing financial and management support to growers. This is partly a reflection of the number of cooperatives operating in the two regions, but it also indicates closer working relationships between growers and packers in these areas.

HARVESTING

Costs

Harvesting costs averaged 34 cents per bushel in the Northwest, compared with 44 cents in the Northeast (table 3). Included in harvesting costs were picking costs (includes supervision and labor camp maintenance costs) and hauling costs (includes costs of loading and delivering the fruit to the packinghouse or to storage facilities). Data on bin charges or rentals were not collected as part of the study. ^{4/}

^{4/} This cost was estimated at 10 cents per bushel by Kelsey in a 1970 Michigan study. See Myron Kelsey and others, Economics of Apple Production in Southwestern Michigan. Ag. Econ. Rpt. No. 184, Mich. State Univ., Feb. 1971.

Table 2--Sample firms providing services to apple growers, by type of service, 1969-70

Service	North- east	Lake States	Appa- lachia	North- west	Cali- fornia	Total
	<u>Number of firms</u>					
Extension of credit for purchasing supplies:						
Under contract	2	4	3	27	6	42
No contract	0	5	0	11	0	16
Extension of credit for hiring production labor:						
Under contract	2	0	1	18	6	27
No contract	0	1	0	9	0	10
Extension of credit for hiring harvest labor:						
Under contract	4	0	3	29	7	43
No contract	0	1	0	17	0	18
Advanced payment before harvest:						
Under contract	4	2	3	29	8	46
No contract	0	4	0	10	0	14
Orchard supervision:						
Under contract	5	1	1	38	2	47
No contract	1	0	1	7	0	9

Picking costs ranged from a low of 24 cents per bushel for low-cost firms in the Northwest to 45 cents per bushel for high-cost firms in the Northeast. There are several reasons for the differences, including cultural practices and type of labor used.

Cultural practices result in lower picking costs in the Northwest than in other regions. Irrigated orchards in the Northwest have high yields resulting from high density plantings of small trees of uniform size. This provides opportunities for efficiencies in apple picking. Apples on small trees are easier to harvest because more of the crop can be harvested by workers standing on the ground. A 1968 study indicated that pickers in Washington State averaged 18.1 boxes (35-lb. field crates) per hour in dwarf orchards, compared with 11.8 boxes per hour in standard orchards. ^{5/} The report concluded that every added foot of ladder used cut the picking rate by four-tenths of a box per hour.

^{5/} M. F. Miller and W. R. Butcher, Labor Productivity in Apple Picking. Wash. Agr. Expt. Sta., Bull. 752, Wash. State Univ., Pullman, Wash., Mar. 1972.

Table 3--Apple picking and hauling costs, five major production regions, 1969/70

Region	High third of sample firms	Middle third of sample firms	Low third of sample firms	Average
<u>Dollars per bushel</u>				
Picking costs:				
Northeast	0.45	0.34	0.29	0.36
Lake States .....	.43	.37	.34	.37
Appalachia--				
North <u>1/</u> .....	.39	.31	.25	.33
South <u>2/</u> .....	.36	.30	.28	.32
All Appalachia .....	.38	.31	.26	.33
California .....	.32	.31	.28	.31
Northwest--				
Wenatchee-Okanogan,				
Washington <u>3/</u> .....	.33	.28	.24	.28
Yakima, Washington <u>3/</u> .....	.33	.27	.24	.28
Idaho, Oregon, Colorado	NA	NA	NA	.26
All Northwest .....	.33	.27	.24	.28
All Northwest (35-lb. field box basis) .....	.27	.22	.20	.23
Hauling costs:				
Northeast .....	.11	.06	.04	.08
Lake States .....	.08	.05	.04	.06
Appalachia--				
North <u>1/</u> .....	.11	.05	.04	.07
South <u>2/</u> .....	.14	.10	.05	.10
All Appalachia .....	.12	.06	.04	.08
California	NA	NA	NA	.05
Northwest--				
Wenatchee-Okanogan,				
Washington <u>3/</u> .....	.08	.04	.03	.05
Yakima, Washington <u>3/</u> .....	.08	.06	.03	.06
Idaho, Oregon, Colorado	NA	NA	NA	.10
All Northwest .....	.09	.05	.03	.06
All Northwest (35-lb. field box basis) .....	.07	.04	.02	.05
Total costs: <u>4/</u>				
Northeast .....	.56	.40	.33	.44
Lake States .....	.51	.42	.38	.43
Appalachia--				
North <u>1/</u> .....	.50	.36	.29	.40
South <u>2/</u> .....	.50	.40	.33	.42
All Appalachia .....	.50	.37	.30	.41
California	NA	NA	NA	.36
Northwest--				
Wenatchee-Okanogan,				
Washington <u>3/</u> .....	.41	.32	.27	.33
Yakima, Washington <u>3/</u> .....	.41	.33	.27	.34
Idaho, Oregon, Colorado	NA	NA	NA	.36
All Northwest .....	.42	.32	.27	.34
All Northwest (35-lb. field box basis) .....	.34	.26	.22	.28

NA means not available.

1/ Virginia (north of Roanoke), Maryland, Delaware, West Virginia, and Pennsylvania.

2/ Virginia (south of Roanoke) and North Carolina.

3/ And other nearby points.

4/ Total costs were derived by summing picking and hauling costs.

The percentage of apples picked by local labor, based on survey firms, was 44 percent in the Northwest, compared with 20 percent in the Northeast and 10 percent in the Lake States (table 4). Local labor normally does not require special housing or labor camps. Domestic migrants were used for harvesting 71 percent of the apples in Appalachia and 90 percent in the Lake States. Growers in the Northeast were the heaviest users of foreign nationals and offshore labor.

Table 4--Type of labor used in harvesting apples, five major production regions

Region	Local	Domestic migrants	Foreign national and offshore labor <u>1/</u>
		<u>Percent</u>	
Northeast.....	19.7	44.4	35.9
Lake States.....	9.6	89.6	.8
Appalachia.....	19.0	70.8	10.2
California.....	53.2	38.6	8.2
Northwest.....	43.9	54.7	1.4

1/ Offshore laborers are primarily Puerto Rican contract workers.

Hauling costs from the orchard to the packing shed or storage ranged from 5 cents per bushel in the Wenatchee-Okanogan, Wash., area to 10 cents in South Appalachia and in the Idaho, Oregon, and Colorado area. Hauling costs are a function of distance, and variations in this expense generally reflect the density of apple production in each area. In all of the regions, the low-cost firms were able to keep hauling costs at 3 or 4 cents per bushel. Conversely, high-cost firms in the Northeast and Appalachia incurred per bushel hauling costs of 11 and 12 cents, respectively.

Losses

Packers were asked to estimate harvesting losses (drops or otherwise damaged apples) from their own acreage and from that of their growers. Results indicate that growers in the Northwest experienced minimum losses (table 5). Average losses for sample firms ranged from 3.5 percent in the Northwest to 10.6 percent in the Northeast. Especially noteworthy was the difference between high-loss versus low-loss sample firms. In all areas, the high third of sample firms had losses that were 2½ times as large as the low third of sample firms.

Table 5-Losses from harvesting, five major production regions, 1969/70

Region	High third of sample firms	Middle third of sample firms	Low third of sample firms	Average
	<u>Percent</u>			
Northeast	14.5	9.4	4.5	10.6
Lake States	10.9	6.2	4.4	7.5
Appalachia	12.5	8.0	3.1	8.3
California	12.6	3.6	2.7	6.9
Northwest	5.4	2.3	.9	3.5

The extent of harvest losses will vary by the variety of apple produced, the weather, and the use of growth regulants. In the 1969/70 season, hail, freezing weather, and other climatic conditions increased the losses of some growers. Use of growth regulants to prevent drops was more extensive in the Northwest in the fall of 1969 than in other production regions, and hence losses were considerably lower in that region. Drops do not necessarily represent a complete economic loss. Depending on the season and the price of apples for juice, it is often feasible to pick up drops and for growers to realize some return for this fruit.

STORAGE PRACTICES AND CHARGES

Types of Storage

The apple industry primarily uses two types of cold storage--regular atmosphere (RA) and controlled atmosphere (CA). According to the International Apple Institute, slightly more than half the apples stored in 1972/73 went into regular atmosphere storage, compared with nearly 100 percent 15 years ago (table 6). Most of the remainder were sealed in controlled atmosphere storage, where the oxygen in the air is reduced and the carbon dioxide and nitrogen levels are increased to slow the respiration rate of the fruit.

Controlled atmosphere is especially effective in extending the marketing season into the spring and summer months. After March 1 of each year, a majority of apples marketed move from controlled atmosphere storage. The volume of apples in storage past May 1 has doubled in the past 15 years, with all of the

Table 6--Fresh apple storage holdings, United States, 1957/58-1972/73

Season	December 1				May 1			
	RA	CA	Total fresh:	RA	CA	Total fresh:	RA	CA
			: holdings			: holdings		
			-----1,000 bushels-----	Percent		-----1,000 bushels-----	Percent	Percent
1957/58	44,549	1,729	46,278	96.3	3.7	3,303	3,856	85.7
1958/59	43,091	3,200	46,291	93.1	6.9	5,959	7,688	77.5
1959/60	38,261	3,922	42,183	90.7	9.3	3,145	4,132	76.1
1960/61	31,370	4,598	35,968	87.2	12.8	3,110	4,351	71.5
1961/62	36,898	6,646	43,545	84.7	15.3	2,978	5,382	55.3
1962/63	32,903	8,491	41,394	79.5	20.5	2,647	5,815	45.5
1963/64	37,795	10,018	47,813	79.0	21.0	2,867	6,163	46.5
1964/65	34,685	12,481	47,166	73.5	26.5	4,064	8,526	47.7
1965/66	32,329	12,911	45,240	71.5	28.5	2,340	6,767	34.6
1966/67	31,809	13,206	45,015	70.7	29.3	4,277	9,143	46.8
1967/68	25,883	12,959	38,842	66.6	33.4	2,162	6,164	35.1
1968/69	24,287	14,612	38,899	62.4	37.6	2,663	7,265	36.7
1969/70	36,977	16,856	53,833	68.7	31.3	2,722	9,083	30.0
1970/71	29,510	18,510	48,020	61.5	38.5	2,617	9,991	26.2
1971/72	30,913	19,135	50,048	61.8	38.2	2,187	10,376	21.1
1972/73	22,422	19,570	41,992	53.4	46.6	1,305	7,489	17.4

Note: RA--stored in regular atmosphere. CA--stored in controlled atmosphere.
Source: International Apple Institute.

increase being in apples stored in CA. In fact, holdings of RA fruit have trended downward and constituted roughly 17 percent of the May 1, 1973, holdings.

During 1962/63-1971/72, December 1 storage holdings in all the regions increased (app. table 5). However, some shifts occurred in each region's share of total holdings. There was a downward trend in the relative share of December 1 holdings in the Eastern region and an upward trend in the Central and Western regions (fig. 1).

During the same period, total May 1 storage holdings in the Eastern and Central regions held steady, while May 1 holdings in the Western region increased. The industry in the Western region has been expanding its CA storage capacity and is holding more of its apples for later distribution to market outlets. Other regions are distributing a greater portion of their apples earlier in the storage season. As a result, the relative share of the May 1 storage holdings in the Western region has been increasing in recent years.

Charges

In 1969/70, regular atmosphere storage charges averaged 29 cents per bushel in the Lake States, 30 cents in Appalachia, 33 cents in the Northeast, and 35 cents in the Northwest (table 7). The difference in charges between the high, middle, and low third of firms was the greatest in the Northwest (15 cents) and the least in the Northeast (8 cents).

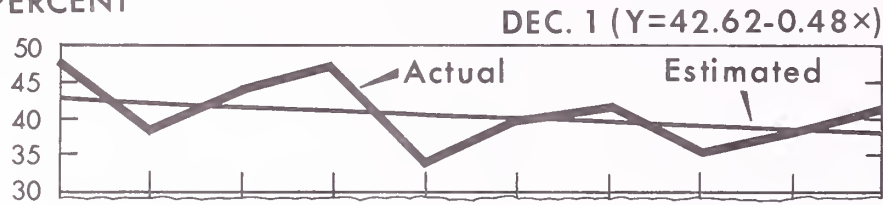
In most regions, controlled atmosphere storage charges were generally 25 to 35 cents higher than RA storage charges, averaging 57 cents per bushel in the Lake States, 64 cents in the Northeast, and 69 cents in the Northwest. CA storage charges for high-charge firms in the Wenatchee-Okanagan district of Washington State were 96 cents per bushel--the highest in the country. In contrast, low-charge firms in the Lake States had CA storage charges of only 49 cents per bushel, and those in Yakima, Wash., had charges of 50 cents. The average for all sample firms in California was 43 cents per bushel.

Charges for fresh apple storage space in all regions apparently reflect the supply and demand for this service. In California and the Lake States, where many other deciduous fruits are produced, storage facilities are not exclusively for apples. Because of seasonal variation in the demand for storage space, there is usually adequate space available for apples, and storage firms compete for business by lowering rates.

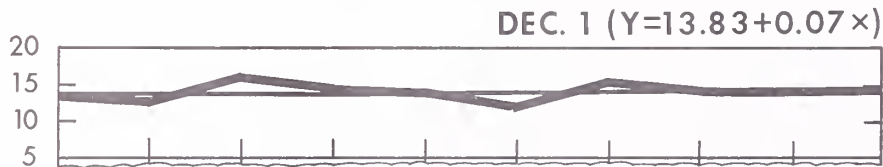
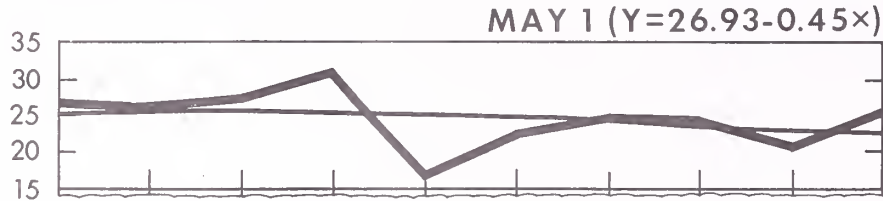
In the Northwest region, RA and CA storage facilities tend to specialize, relying nearly 100 percent on apples and pears. In recent years, apple and pear production has increased in the region. As a result, there has been a strong demand for both RA and CA storage space in the Northwest, particularly CA. This was especially true in 1969/70, when the Northwest apple crop was the largest on record. In addition, the average storage season in the Northwest is longer than that in other regions. For example, apples stored in CA facilities in Washington State are marketed as late as the next September from Washington State.

REGIONAL SHARES IN TOTAL FRESH APPLE HOLDINGS

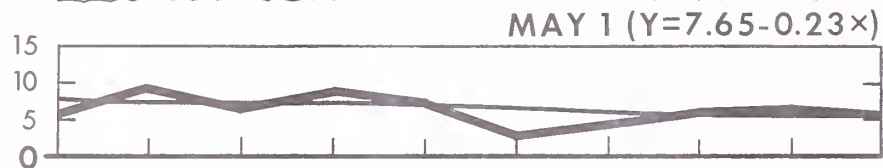
PERCENT



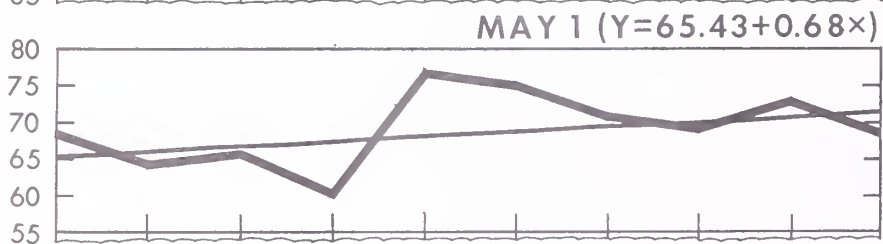
EASTERN
REGION



CENTRAL
REGION



WESTERN
REGION



1962-63 63-64 64-65 65-66 66-67 67-68 68-69 69-70 70-71 71-72

Figure 1

Table 7--Apple storage charges, by type of storage, five major production regions, 1969/70

Type of storage and region	High third of sample firms	Middle third of sample firms	Low third of sample firms	Average
<u>Dollars per bushel</u>				
Regular atmosphere:				
Northeast	0.38	0.35	0.30	0.33
Lake States	.38	.33	.24	.29
Appalachia--				
North 1/	.34	.30	.23	.30
South 2/	NA	NA	NA	.35
All Appalachia	.35	.30	.24	.30
California	.29	.22	.20	.23
Northwest--				
Wenatchee-Okanogan,				
Washington 3/	.43	.37	.33	.38
Yakima, Washington 3/	.33	.32	.27	.32
Idaho, Oregon, Colorado	NA	NA	NA	.35
All Northwest	.42	.33	.27	.35
Controlled atmosphere:				
Northeast	.71	.65	.62	.64
Lake States	.69	.54	.49	.57
Appalachia--				
North 1/	.69	.64	.60	.63
South 2/				--
All Appalachia	.69	.64	.60	.63
California	NA	NA	NA	.43
Northwest--				
Wenatchee-Okanogan,				
Washington 3/	.96	.76	.54	.75
Yakima, Washington 3/	.74	.65	.50	.65
Idaho, Oregon, Colorado	NA	NA	NA	.60
All Northwest	.88	.69	.53	.69

NA means not available.

1/ Virginia (north of Roanoke), Maryland, Delaware, West Virginia, and Pennsylvania.

2/ Virginia (south of Roanoke) and North Carolina.

3/ And other nearby points.

Losses

Managers of sample firms were asked to estimate their average RA storage losses from shrinks and rots for December 1969-February 1970 and for March-May 1970. Average losses during the December-February period varied from 2.8 percent in the Northwest to 5.7 percent in the Lake States (table 8). However, there were considerable differences within each region between the high, middle, and low third of firms. Low-loss firms averaged 1.7 percent or less, with firms in the Northwest having only very minor or negligible amounts of shrinks or rots. The average loss for high-loss firms was 5.5 percent, with firms in Appalachia and the Northeast reporting that 10 percent of their apples in storage was affected by shrink or rot. The major factors influencing storage losses appeared to be the maturity of apples put into storage, keeping quality of apples stored, methods used in handling the fruit, and the ability of the individual manager to market fruit before it was in trouble from decay and other deterioration.

During the March-May 1970 period, average RA storage losses ranged from 3.6 percent in the Northwest to 7.8 percent in Appalachia. These losses were .8 to 2.4 percentage points higher than average RA storage losses during the December-February period. In terms of high- and low-loss firms, RA storage losses during March-May 1970 ranged from 12.3 percent for high-loss firms in Appalachia to a remarkably low .4 percent for low-loss firms in the Northwest.

Estimates of average CA storage losses were obtained for March-May 1970 and for June 1970 to the end of the storage season. Such losses during March-May varied from 2.3 percent in California to 5.9 percent in the Northeast (table 9). In all regions, average CA spoilage losses during March-May 1970 were below those for RA storage losses for the same period. This is as expected, since the best quality apples are generally put in CA storage, and the respiration rate of the fruit is slowed under CA conditions.

Again, differences between the high, middle, and low third of firms within each region were considerable. Low-loss firms averaged 1.8 percent or less shrink and rot losses. In the Northwest region, low-loss firms showed only a trace of shrinks and rots. High-loss firms averaged 5.8 percent and up, with high-loss firms in the Northeast having 13 percent of their volume affected. Additional factors influencing CA storage losses appear to be management's ability to judge the condition of fruit prior to moving it into storage and the ability to operate a more complex storage program.

From June to the end of the marketing season--which can be as late as September--CA losses from shrink and rots were 1.4 to nearly 3.0 percentage points higher than during March-May. Average CA losses for the summer marketing period ranged from 4.4 percent in the Northwest to 8.8 percent in the Northeast. Northeast firms with high losses averaged 14.2 percent shrink and rots, compared with .3 percent for low-loss firms in Northwest.

Table 8--Apple losses from shrinks and rots, regular atmosphere storage, five major production regions, 1969/70

Period and region	High third of sample firms	Middle third of sample firms	Low third of sample firms	Average
	<u>Percent</u>			
Dec. 1969-Feb. 1970:				
Northeast	10.0	4.9	1.7	4.8
Lake States	9.1	5.7	.6	5.7
Appalachia	10.3	3.8	1.1	5.4
California	NA	NA	NA	4.8
Northwest	5.5	1.6	.1	2.8
Mar.-May 1970:				
Northeast	9.7	5.3	4.0	6.3
Lake States	NA	NA	NA	7.0
Appalachia	12.3	5.7	1.9	7.8
California	NA	NA	NA	5.6
Northwest	7.3	2.9	.4	3.6

NA means not available.

Table 9--Apple losses from shrinks and rots, controlled atmosphere storage, five major production regions, Mar.-June 1970

Period and region	High third of sample firms	Middle third of sample firms	Low third of sample firms	Average
	<u>Percent</u>			
Mar.-May 1970:				
Northeast	13.1	5.0	1.8	5.9
Lake States	7.4	4.7	.7	4.7
Appalachia	NA	NA	NA	6.5
California	NA	NA	NA	2.3
Northwest	5.8	2.6	.2	3.0
June to end of season:				
Northeast	14.2	5.2	1.2	8.8
Lake States	12.6	7.7	4.6	7.5
Appalachia	NA	NA	NA	NA
California	NA	NA	NA	NA
Northwest	8.9	3.5	.3	4.4

NA means not available.

PACKING SHED OUTPUT

Output Per Hour

To determine the scale of apple packing operations among the regions, the firm managers were asked to estimate the average hourly output in their packing sheds. As might be expected, there was a wide range in output both within and among regions (table 10). Firms in the Northwest had the highest average hourly output--371 cartons per hour. Within the region, average hourly output ranged from 411 cartons in the Wenatchee-Okanogan, Wash., area to 331 cartons in the Yakima, Wash., area. The smallest scale plants were located in the Northeast (120 cartons per hour), in California--north of San Francisco (127 cartons), and in the Lake States (138 cartons).

In all regions and areas, the large firms averaged more than twice the output per hour of the small firms. The extremes were 74 cartons per hour for small firms in the Northeast and 668 cartons per hour for large firms in Wenatchee-Okanogan, Wash. The average small-size shed in the Northwest was larger than the average medium-size shed in Appalachia and California and the average large-size shed in the Northeast and the Lake States.

Seasonal Volume

A second measure of the magnitude of a packing operation is the volume of apples packed per season (table 11). In some instances, regions with relatively small sheds were able to pack a relatively large volume of fruit per season. The volume packed in any one season is, of course, influenced by the quantity of apples produced and storage capacity in the area. The 1969/70 crop was the largest on record, so average seasonal packing volume for many plants was above their normal average.

Sample firms in the Northwest generally packed a greater volume of apples than did firms in other regions. The volume of apples packed during the 1969/70 season ranged from an average of nearly 70,000 cartons in South Appalachia to over 380,000 cartons in Yakima, Wash. Low-volume firms in South Appalachia averaged only 32,000 cartons during the season, while high-volume firms in Yakima far exceeded that amount--over 790,000 cartons. Low-volume firms in the Northwest packed a volume of apples equivalent to or greater than that packed by middle-volume firms in other regions.

The volume of apples packed in a season is a function of hourly output and length of the packing season. The length of the usual packing season for each of the regions is indicated in the tabulation on page 18.

Table 10.--Apple packing shed output per hour, five major production regions, 1969/70

Region	High third of sample firms	Middle third of sample firms	Low third of sample firms	Average
<u>Cartons per hour</u>				
Northeast	186	101	74	120
Lake States	212	125	75	138
Appalachia--				
North <u>1/</u>	354	182	88	208
South <u>2/</u>	325	215	145	228
All Appalachia	348	195	97	213
California	248	164	94	<u>3/</u> 169
Northwest--				
Wenatchee-Okanogan, Washington <u>4/</u> ..	668	330	234	411
Yakima, Washington <u>4/</u>	464	309	221	331
Idaho, Oregon, Colorado	508	344	226	358
All Northwest	569	320	226	371

1/ Virginia (north of Roanoke), Maryland, Delaware, West Virginia, and Pennsylvania.

2/ Virginia (south of Roanoke) and North Carolina.

3/ Average output per hour for California, north of San Francisco, was 127 cartons and for California, south of San Francisco, was 208 cartons.

4/ And other nearby points.

Table 11--Apple packing shed output per firm, five major production regions, 1969/70

Region	High third of sample firms	Middle third of sample firms	Low third of sample firms	Average
<u>Cartons per firm</u>				
Northeast	215,280	108,297	52,622	130,050
Lake States	179,107	98,706	41,514	98,752
Appalachia--				
North <u>1/</u>	239,292	105,424	38,769	127,828
South <u>2/</u>	119,340	57,014	32,102	68,526
All Appalachia	215,583	90,903	36,221	113,811
California	213,200	119,908	44,115	<u>3/</u> 126,158
Northwest--				
Wenatchee - Okanogan, Washington <u>4/</u> :	498,756	256,385	145,936	300,356
Yakima, Washington <u>4/</u>	790,591	241,479	127,705	381,911
Idaho, Oregon, Colorado	NA	NA	NA	254,510
All Northwest	617,985	238,238	119,808	325,344

NA means not available.

1/ Virginia (north of Roanoke), Maryland, Delaware, West Virginia, and Pennsylvania.

2/ Virginia (south of Roanoke) and North Carolina.

3/ Average volume per firm for California, north of San Francisco, was 64,368 cartons and for California, south of San Francisco, was 155,926 cartons.

4/ And other nearby points.

Region	Average Length of Packing Season
	<u>Days</u>
Northeast.....	276
Lake States.....	217
North Appalachia.....	210
South Appalachia.....	80
California.....	122
All Northwest.....	206
Northwest (excluding	218
Idaho, Oregon, and	
Colorado)--	
Wenatchee-Okanogan.....	196
Yakima.....	244

Average output per hour for packing firms in South Appalachia during 1969/70 was about the same as for firms in North Appalachia (table 10). However, the average firm in South Appalachia packed only 54 percent as much fruit (table 11), because it packed for only 80 days, compared with 210 days for the average firm in North Appalachia. Packing firms in South Appalachia are thus geared to packing their crop rapidly so as to sell in the early fall and obtain a premium price.

Firms in the Northeast region had the longest average packing season--276 days. Hence, their average seasonal volume exceeded that of firms in the Lake States, Appalachia, and California, even though their average hourly output was the lowest in the country. Another interesting contrast is between the Yakima and Wenatchee-Okanogan areas of Washington. Even though Yakima sheds had lower hourly output than did sheds in Wenatchee-Okanogan, they operated a longer season and averaged 80,000 more bushels packed.

This suggests that there may be over capacity in packing facilities in Wenatchee-Okanogan and that recent attempts to reduce the number of packing sheds through consolidation and merger are in the right direction.

PACKING COSTS AND SELLING CHARGES

In this study, packing costs were divided into labor costs, container costs and overhead costs. Labor costs include: (1) costs involved in receiving the apples at the packing shed from the grove or from the storage warehouse; (2) costs of grading labor; (3) costs of packing labor, including piece workers; (4) costs of labor involved in container assembly; (5) costs of labor involved in shipping--stamping, labeling, stacking, and loading the containers; and (6) costs of packing line supervisory labor. Container costs include costs of cartons, molded trays, bags, cells, overwraps, liners, labels, and other items

used in packaging fruit. Overhead costs include depreciation on buildings and equipment; operating costs such as costs of utilities, repairs, and maintenance; other operating costs; taxes; insurance; and management and office salaries.

Selling charges cover salesmen's salaries and commissions, costs of telephone and wire services used in connection with selling and billing costs.

Labor Costs

Average labor costs per packed container were lowest in the Lake States (32 cents) and the Northeast (35 cents) and highest in Appalachia (44 cents) and the Northwest (46 cents) (table 12). Differences in labor costs between high-cost firms and low-cost firms--indicating considerable variation in labor costs--were 17 cents in the Northeast, 22 cents in the Lake States, 26 cents in the Northwest, 29 cents in Appalachia, and 38 cents in California.

Table 12--Apple packing labor costs, five major production regions, 1969/70

Region	: High third : of : sample firms	: Middle third : of : sample firms	: Low third : of : sample firms	: Average
<u>Dollars per carton</u>				
Northeast	0.43	0.36	0.26	0.35
Lake States .....	.47	.33	.25	.32
Appalachia .....	.58	.44	.29	<u>1/</u> .44
California .....	.63	.37	.25	<u>2/</u> .40
Northwest .....	.62	.46	.36	<u>3/</u> .46

1/ \$0.44 in North Appalachia and \$0.47 in South Appalachia.

2/ \$0.57 north of San Francisco and \$0.28 south of San Francisco.

3/ \$0.48 in Wenatchee-Okanogan; \$0.44 in Yakima; and \$0.47 in Idaho, Oregon, and Colorado.

Differences within and among regions were influenced by the percentage of apples packed in trays instead of in bags and bulk cartons. 6/ In California

6/ Fresh apples generally are packed in fiberboard cartons for shipment to wholesale outlets. Three types of packs are predominantly used: (1) tray packs consisting of 4 to 5 layers of apples placed on molded trays in the

south of San Francisco, where only 5 percent of the apples were packed in trays, average labor costs per carton were 28 cents (table 13). On the other hand, in Appalachia, the Northwest, and California north of San Francisco, 39 to 79 percent of the apples were packed in trays, and labor costs averaged 44 cents or more per carton.

In the Appalachia region, bag cartons containing 12/4 lb. or 15/3 lb. poly bags are packed in addition to the more common sizes such as 12/3 lbs. and 10/4 lbs. cartons. As a result, labor costs per carton are estimated to be 2 to 3 cents higher in this region than they would be if only the more common size cartons were packed.

In the Northwest, some packers wrap with paper each apple in the top layer of a tray pack, and occasionally all the apples in the pack. These practices further influence labor costs in the region.

Another factor influencing labor costs is the quality of tree-run apples that are packaged--in general, the higher the quality of the fruit, the lower the labor costs. In California north of San Francisco, only 40 percent of the apples moving across the packing line were U. S. No. 1 or better, while in all other regions, 60 percent or more of the fruit was U. S. No. 1 or better (app. table 6).

In table 14, firms in each region are arrayed according to the percentage of U. S. No. 1 or better fruit they packaged in 1969/70. For firms in the top-third category, the percentages ranged from 72.8 percent in California, south of San Francisco, to 91.0 percent in the Northeast region. In general, firms in the top-third category had lower average labor costs per packed carton than did firms in the middle- and low-third categories. 7/

6/ (Cont.) fiberboard carton--the number of trays varies depending on the size of apples; (2) bag cartons where the fiberboard carton serves as a master container commonly holding 10/4 lb. or 12/3 lb. poly bags; (3) bulk cartons in which apples are jumble or loose packed in the fiberboard carton.

7/ Greig, W. Smith, and O'Rourke, A. Desmond, cited three main factors influencing operating costs of the packing line: the quality of fruit, internal organization of workers, and size of plant. See Apple Packing Costs in Washington, 1971: An Economic-Engineering Analysis, Bull. 755, Wash. Agr. Exp. Sta., May 1972. The authors state that packing charges need to be more directly related to the actual costs of handling different qualities of fruit. Dewey, D.H. and Schueneman, T.V. drew a similar conclusion in Quality and Packout of Storage Apples--Their Effects on Costs and Returns, Research Rpt. 147, Farm Science, Mich. State Univ., Agr. Exp. Stat., Feb. 1972. They concluded that the opportunity for profit from fresh-market apples is greatly diminished when low-quality apples are grown and stored. These conclusions are consistent with recent attempts by some packers in the Northwest and Michigan to penalize growers who bring in high percentage of low-quality fruit.

Table 13--Apple packing labor costs, by type of container used, five major production regions, 1969/70

Region	Labor costs	Type of containers				Total
		Trays	Bag cartons	Bulk carton	Other	
	Dollars per carton	Percent				
Northeast.....	0.35	17	56	3	<u>1</u> / 24	100
Lake States.....	.32	14	68	7	<u>2</u> / 11	100
Appalachia:						
North.....	.44	39	53	5	3	100
South.....	.47	47	42	8	3	100
All Appalachia.....	.44	40	51	6	3	100
California:						
North of S.F. ....	.57	55	20	25	<u>3</u> /	100
South of S.F. ....	.28	5	19	76	0	100
All California.....	.40	18	19	63	<u>3</u> /	100
Northwest:						
Wenatchee-Okanogan,						
Washington.....	.48	79	8	4	<u>4</u> / 9	100
Yakima, Washington....	.44	71	13	6	<u>5</u> / 10	100
Idaho, Oregon,						
Colorado.....	.47	65	9	25	1	100
All Northwest.....	.46	75	10	7	8	100

- 1/ Includes 19 percent cell packs.
- 2/ Includes 9 percent overwraps.
- 3/ Less than 0.5 percent.
- 4/ Includes 6 percent cell packs.
- 5/ Includes 4 percent cell packs.

Table 14--Quality of apples compared with labor packing costs, five major production regions, 1969/70

Item	High third of		Middle third of		Low third of		Average
	Pct.	Dol.	Pct.	Dol.	Pct.	Dol.	
Northeast:							
U.S. No. 1 and better.....	91.0	0.32	80.1	0.37	73.1	0.34	79.6
Labor costs per packed container.....							0.35
Lake States:							
U.S. No. 1 and better.....	78.7	.32	71.1	.32	56.6	.34	65.2
Labor costs per packed container.....							.32
Appalachia:							
U.S. No. 1 and better.....	85.7	.43	71.2	.44	54.4	.47	68.7
Labor costs per packed container.....							.44
California:							
U.S. No. 1 and better.....	72.8	.28	51.0	.45	31.8	.39	1/ 52.3
Labor costs per packed container.....							.40
Northwest:							
U.S. No. 1 and better.....	88.3	.44	80.7	.49	69.4	.47	2/ 79.1
Labor costs per packed container.....							.46

1/ In California, north of San Francisco, U.S. No. 1 and better was 40.3 percent, and south of San Francisco, 62.1 percent.

2/ In Wenatchee-Okanogan, U.S. No. 1 and better was 80.5 percent; in Yakima, 80.2 percent; and in Idaho, Oregon, and Colorado, 69.2 percent.

In the Lake States and Appalachia, firms in the middle-third category had lower labor costs than did firms in the low-third category. However, the reverse was true for middle- and low-ranking firms in the Northeast, California, and Northwest regions, although differences were small.

Firms packing a high proportion of low-quality apples in California averaged 31.8 percent U.S. No. 1 or better. In California, it was the practice of firms having low-quality apples to remove U.S. No. 1 or better apples from the packing line instead of removing lower grade fruit. These firms were able to save on labor costs over firms having about equal amounts of U. S. No. 1 apples or better and lower quality fruit. Thus, the more apples that have to be removed from the grading line regardless of quality, the greater the labor costs.

Other factors which affect labor costs in packing apples for the fresh market include volume of fresh apples packed and proportion of Golden Delicious, McIntosh, and other soft apple varieties packed (app. table 7).

Container Costs

Costs of tray-pack cartons plus filler materials--trays, liners, and wraps--ranged from 53 cents in the Lake States to 65 cents in California (table 15). Differences in container costs may be partly attributable to differences in the weight and strength of boxes used, the amount of liners and wraps used, and the amount of printing and labeling. Firms in the Northwest region, for example, frequently use a relatively heavy shipping container because of the long distance between the packing shed and the market.

The type of market being served, as well as its distance from the packing shed, will also influence a packer's decision as to the quality of container used, and hence the cost of containers. For example, firms in South Appalachia, which primarily serve nearby Southeastern and South-central States, had an average cost of 53 cents for tray packs. Firms in North Appalachia, however, send a higher percentage of their supply to metropolitan areas along the east coast and also store more of their packed containers. Their costs averaged 60 cents per tray pack. Differences in container costs may also reflect regional pricing patterns by suppliers.

Average costs of tray-pack containers ranged from a low of 47 cents for low-cost firms in the Lake States to a high of 73 cents for high-cost firms in the Northwest. For all regions, the average cost of tray packs for low-cost firms was under 55 cents, while for high-cost firms, the average was over 61 cents. The difference between the high-cost group and the low-cost group was narrowest in the Northeast--9 cents--and widest in Appalachia--21 cents.

Average costs for bag cartons, including the bags, and for bulk cartons generally followed the cost patterns of tray packs, with lower costs being incurred in the Northeast and the Lake States than in either Appalachia or the Northwest. Average bag container costs ranged from 40 cents for low-cost firms in the Northeast to 67 cents for high-cost firms in the Northwest. For all regions, the average cost of bag cartons for low-cost firms was under 50 cents,

Table 15--Apple packing container costs, five major production regions, 1969/70

Cost item and region	High third of sample firms	Middle third of sample firms	Low third of sample firms	Average
<u>Dollars per carton</u>				
Tray packs:				
Northeast.....	0.62	0.57	0.52	0.58
Lake States.....	.63	.55	.47	.53
Appalachia.....	.70	.63	.49	<u>1/</u> .58
California.....	NA	NA	NA	.65
Northwest.....	.73	.62	.54	<u>2/</u> .63
Bag cartons: <u>3/</u>				
Northeast.....	.50	.45	.40	.46
Lake States.....	.51	.47	.41	.46
Appalachia.....	.59	.50	.42	<u>4/</u> .50
California.....	NA	NA	NA	<u>5/</u> .48
Northwest.....	.67	.56	.47	<u>6/</u> .55
Bulk cartons:				
Northeast.....	NA	NA	NA	.32
Lake States.....	NA	NA	NA	.30
Appalachia.....	.40	.37	.30	<u>7/</u> .37
California.....	NA	NA	NA	.34
Northwest.....	.41	.38	.33	<u>8/</u> .38
Average: <u>9/</u>				
Northeast.....	.58	.44	.39	.49
Lake States.....	.55	.50	.42	.48
Appalachia.....	.69	.54	.45	<u>10/</u> .53
California.....	.62	.50	.40	<u>11/</u> .47
Northwest.....	.72	.61	.53	<u>12/</u> .62

NA means not available.

1/ The average cost of tray packs was \$0.60 in North Appalachia and \$0.53 in South Appalachia.

2/ The average cost of tray packs was \$0.61 in Wenatchee-Okanogan; \$0.62 in Yakima; and \$0.72 in Idaho, Oregon, and Colorado.

3/ The average of all bags packed (10/4's, 12/3's, etc.) In the Appalachia area, this includes some 15/3's and 12/4's.

4/ The average cost of bag cartons was \$0.50 in both North and South Appalachia.

5/ The average cost of bag cartons in California was \$0.47 north of San Francisco, and \$0.48 south of San Francisco.

6/ The average cost of bag cartons was \$0.58 in Wenatchee-Okanogan; \$0.52 in Yakima; and \$0.58 in Idaho, Oregon, and Colorado.

7/ The average cost of bulk containers was \$0.36 in North Appalachia and \$0.38 in South Appalachia.

8/ The average cost of bulk container was \$0.36 in Wenatchee-Okanogan; \$0.35 in Yakima; and \$0.39 in Idaho, Oregon, and Colorado.

9/ Includes cell packs and overwraps but excludes other bulk container and other miscellaneous containers.

10/ The average cost of all containers was \$0.53 in North Appalachia and \$0.51 in South Appalachia.

11/ The average cost of all containers in California was \$0.56 north of San Francisco, and \$0.40 south of San Francisco.

12/ The average cost of all containers was \$0.61 in Wenatchee-Okanogan; \$0.60 in Yakima; and \$0.65 in Idaho, Oregon, and Colorado.

while that for high-cost firms was over 50 cents. The difference between the high-cost group and the low-cost group was narrowest in the Northeast and Lake States, around 10 cents, and widest in the Northwest at nearly 20 cents.

The overall average cost of containers indicates that costs in the Northeast, Lake States, and California were almost identical and somewhat lower than in Appalachia and the Northwest. Firms in the Northwest, where a high percentage of trays are packed, incurred average costs 9 cents above those of any other region. However, in all regions a spread of 13 to 24 cents between average container costs for the low- and high-cost firms was observed.

Selling Charges

Charges for selling fresh apples were fairly comparable in all regions, with the exception of substantially higher charges in the Northeast (table 16). Selling agencies in California and the Northwest charged the lowest rates--an average of 14 to 15 cents per carton. Charges in Appalachia and the Lake States were 3 to 4 cents higher. Selling agencies in the Northwest were, in general, large firms that were able to obtain economies of size in their selling operations. Unit charges for selling were frequently quoted by west coast firms, while both unit charges and 5- to 6-percent commission rates were common in Appalachia and the Lake States. In the Northeast, selling charges usually were 8 percent, and unit charges were higher than elsewhere, thus accounting for the region's 26-cent average selling charge.

The range in selling charges between the low third of sample firms and the high third of firms was from 11 cents in the Northwest to 30 cents in the Northeast. For all regions, the average selling charge per packed container was under 15 cents for the low third of firms but over 20 cents for the high third of firms.

An important consideration is how good a job the seller is doing in obtaining the best return for the grower or packer. Generally, the low charge firms were doing their own selling and billing, while those with higher selling charges were using brokers or sales agencies.

Overhead

On the low side, overhead costs ranged from 14 cents in the Lake States to 18 cents in California south of San Francisco (table 17). Considerable differences were found between North and South Appalachia and between the two California areas.

Firms in South Appalachia have about the same packing shed capacity as firms in North Appalachia, but they pack only 54 percent as much fruit. In effect, southern Appalachia firms have high overhead costs but are geared to packing their crop rapidly so as to hit the early fall market and obtain a premium price.

Table 16--Selling charges per packed container of fresh apples,
five major production regions, 1969/70

Region	High third of sample firms	Middle third of sample firms	Low third of sample firms	Average
<u>Dollars per carton</u>				
Northeast.....	0.30	0.26	0.14	0.26
Lake States.....	.25	.17	.12	.18
Appalachia.....	.22	.16	.12	<u>1/</u> .18
California.....	NA	NA	NA	<u>2/</u> .14
Northwest.....	.21	.13	.11	<u>3/</u> .15

NA means not available.

1/ Average selling charges were \$0.16 per packed container in South Appalachia and \$0.18 in North Appalachia.

2/ Average selling charges per packed container in California were \$0.16 north of San Francisco and \$0.14 south of San Francisco.

3/ Average selling charges per packed container were \$0.13 in Yakima and \$0.16 in the other Northwest areas.

In California, average packing shed output per hour was 208 cartons in the area south of San Francisco and 127 cartons in the area north of San Francisco. Seasonal volume per firm was also much higher in the area south of San Francisco, resulting in economies of scale and, hence, lower overhead costs per unit of output.

Of special interest were the relatively high overhead costs in the Northwest. Average overhead costs were 34 cents. Costs ranged from 26 cents in Wenatchee-Okanogan, Wash., to 42 cents in Yakima. Average hourly packing shed output and the average volume of apples packed per firm in the Northwest were almost double those of any other region. This normally would suggest lower rather than higher overhead costs per unit of output.

There are several explanations for the high overhead costs in the Northwest although no conclusions have been reached about the relative importance of each. First, there has been considerable construction of new apple packing facilities in the Northwest relative to other production areas. As a result of new investment being written off the books, depreciation costs may be high compared with older plants more common in other producing regions. Second, the degree of mechanization is high in the Northwest relative to other production areas. Considering the extent of tray packing in the region, average packing costs could be higher without this technology and the new facilities. High overhead costs have resulted from capital being substituted for labor, although labor costs remain high because of the hand labor required in packing trays. Other reasons for the region's high overhead costs include the possibility of a high

Table 17--Average overhead costs, average output per hour, and average volume of fresh apples packed per firm, five major production regions, 1969/70

Region	Overhead	Average output	Average volume
	Dollars	Cartons	Cartons
	per carton	per hour	
Northeast.....	0.15	120	130,050
Lake States.....	.14	138	98,752
Appalachia:			
North.....	.17	208	127,828
South.....	.36	228	68,526
All Appalachia.....	.20	213	113,811
California:			
North of S.F. ....	.48	127	64,368
South of S.F. ....	.18	208	155,926
All California.....	.31	169	126,158
Northwest:			
Wenatchee-Okanogan, Wash. ....	.26	411	300,359
Yakima, Wash. ....	.42	331	381,911
Idaho, Oregon, Colorado ....	.30	358	254,510
All Northwest.....	.34	371	325,344

Table 18--Overhead costs per packed container, five major production regions, 1969/70

Region	High third	Middle third	Low third	Average
	of	of	of	
	sample firms	sample firms	sample firms	
	<u>Dollars per carton</u>			
Northeast.....	0.20	0.13	0.08	0.15
Lake States.....	.22	.13	.08	.14
Appalachia.....	.36	.16	.08	.20
California.....	.61	.27	.10	.31
Northwest.....	.57	.32	.14	.34

ratio of supervisory and management personnel to the volume of apples being packed, the inclusion of waxing costs in the overhead figure, and the possibility of a few old but inefficient plants being operated in the region.

Greig and O'Rourke, in their economic engineering study of 14 Washington State apple packing houses in 1970-71, estimated overhead costs for packing Red Delicious apples as 43.4 cents per box. ^{8/} These costs were broken down as follows: Packing shed and packing equipment overhead--26.7 cents overhead management costs--12.2 cents; and operating costs (electricity, water, gas, telephone, and so forth)--4.5 cents. In addition, they estimated that waxing and fungicide costs were 3.0 cents. Packing shed and packing equipment overhead costs were based on the current estimated replacement costs of new buildings and equipment.

Within regions, there were relatively wide differences in overhead costs between the low, middle, and high third of firms (table 18). In all regions, overhead costs of high-cost firms were 2½ to 6 times larger than costs of the low-cost firms. Even in the Northwest region, where overhead costs were generally higher than in other regions, the overhead costs of low-cost firms were only 14 cents per container, compared with 57 cents for high-cost firms. For low-cost firms in the Northeast, Lake States, and Appalachia, overhead costs averaged only 8 cents per container, while high-cost firms in these regions had overhead costs of 20, 22, and 36 cents, respectively.

Total Packing Costs

For all regions, total packing costs were highest for tray packs (table 19). Since total packing costs are the sum of labor, container, selling, and overhead costs, the total for each region is influenced by all these costs. Average packing costs ranged from \$1.12 per container in the Lake States to \$1.57 per container in the Northwest.

Total tray-pack costs ranged from an average of \$1.17 per carton in the Lake States to \$1.85 in California north of San Francisco. Bag carton costs ranged from a low of \$1.08 for California firms south of San Francisco to a high of \$1.68 per carton for California firms north of San Francisco. Firms in the Lake States and in California south of San Francisco had the lowest costs on bulk cartons--94 cents--while firms in Yakima, Wash., had the highest costs--\$1.34.

Low costs are by no means the only criteria for apple packers and shippers. Equally important is the saleability and marketability of the fresh apples. If higher cost packing operations and containers can be offset through higher returns, then it is certainly profitable to incur these additional expenses.

^{8/} Greig and O'Rourke, op. cit.

Table 19--Total apple packing and selling costs, five major production regions, 1969/70

Region	Tray packs	Bag cartons <u>1/</u>	Bulk cartons	Average <u>2/</u>
<u>Dollars per carton</u>				
Northeast.....	1.34	1.22	1.08	1.25
Lake States.....	1.17	1.10	.94	1.12
Appalachia:				
North <u>3/</u>	1.39	1.29	1.15	1.32
South <u>4/</u>	1.52	1.49	1.37	1.50
All Appalachia.....	1.40	1.32	1.19	1.35
California:				
North of S.F.....	1.85	1.68	NA	1.77
South of S.F.....	NA	1.08	.94	1.00
All California.....	1.50	1.33	1.19	1.32
Northwest:				
Wenatchee-Okanogan, :				
Wash. <u>5/</u>	1.50	1.47	1.25	1.50
Yakima, Wash. <u>5/</u>	1.61	1.51	1.34	1.59
Idaho, Oregon, :				
Colorado.....	1.64	1.50	1.31	1.31
All Northwest.....	1.58	1.50	1.33	1.57

NA = Not available.

1/ Average of all bags packed (10/4's, 12/3's, etc.). In particular, in the Appalachian area this includes some 15/3's and 12/4's.

2/ Includes cell packs and overwraps but excludes other bulk containers and other miscellaneous containers.

3/ Virginia (north of Roanoke), Maryland, Delaware, West Virginia, and Pennsylvania.

4/ Virginia (south of Roanoke) and North Carolina.

5/ And nearby points.

CUSTOM PACKING AND SELLING CHARGES

Firms that pack or sell apples for a fee normally charge custom rates for these services. In the Northeast and Appalachia, custom packing and selling charges were nearly identical to total packing costs, both for each type of container and for the average for all containers (tables 19 and 20). In South Appalachia, average custom charges were 28 cents higher than total packing costs, but the volume of fruit custom packed was small.

In the Northwest, custom charges were higher than total packing costs with the exception of bulk cartons. The average premium for custom packing in the Northwest was 12 cents on tray packs, 10 cents on bag cartons, and 11 cents on the average for all containers. In the Lake States, the premium for custom packing was 11 cents on trays, 4 cents on bag cartons, and 6 cents on the average for all containers.

Differences in charges between the high third of firms and low third of firms on tray packs was widest in the Lake States--65 cents--and narrowest in the Northwest--35 cents.

Custom packers normally do not make a separate charge for overhead. Instead, they build in a margin on labor and container charges to cover their overhead expenses. In the Northeast and Northwest, the tendency was to build this margin into labor charges. In Appalachia and the Lake States, both labor and container charges were used to cover overhead expenses for custom packers.

TERMS OF SALE

Firm managers were asked what terms of sale they used in selling apples. Two methods--f.o.b. shipping point and delivered--were predominantly used, with managers in all regions reporting some sales through consignment and fruit auctions (table 21). Free-on-board sales are generally considered the most favorable terms for the shipper because title and, hence, risk are transferred to the buyer at point of origin, or shipping point. Conversely, delivered sales are advantageous to the purchaser since the shipper maintains ownership until delivery at destination. Many shippers point out that f.o.b. sale adjustments are sometimes necessary if the buyer is not satisfied upon delivery. Hence, while there is a legal distinction between f.o.b. and delivered sales, in actual practice the two terms of sale may be less distinct.

For the apple packing firms in the Northeast and Lake States, f.o.b. and delivered sales were of about equal importance. In Appalachia, about 57 percent of the volume was sold f.o.b. and about 40 percent was sold delivered. But in the Northwest and California, f.o.b. sales made up the largest share--nearly 92 percent in the Northwest and nearly 75 percent in California. Consignment sales comprised about 4 percent of the volume in all regions, except in the Lake States, where less than 2 percent was sold under consignment.

Table 20--Custom apple packing and selling charges, five major production regions, 1969/70

Region and type of container	High third of sample firms	Middle third of sample firms	Low third of sample firms	Average
Dollars per carton <u>1/</u>				
Tray packs:				
Northeast.....	1.48	1.26	0.94	1.34
Lake States.....	1.59	1.27	.94	1.28
Appalachia.....	NA	NA	NA	1.43
California.....	NA	NA	NA	NA
Northwest.....	1.87	1.66	1.52	<u>2/</u> 1.70
Bag cartons: <u>3/</u>				
Northeast.....	NA	NA	NA	1.23
Lake States.....	NA	NA	NA	1.14
Appalachia.....	NA	NA	NA	<u>4/</u> 1.29
California.....	NA	NA	NA	NA
Northwest.....	1.75	1.57	1.34	<u>5/</u> 1.60
Bulk cartons:				
Northeast.....	NA	NA	NA	1.09
Lake States.....	NA	NA	NA	NA
Appalachia.....	NA	NA	NA	<u>6/</u> 1.13
California.....	NA	NA	NA	NA
Northwest.....	1.40	1.27	1.01	<u>7/</u> 1.27
Average: <u>8/</u>				
Northeast.....	1.38	1.14	.85	1.25
Lake States.....	1.44	1.16	.98	1.18
Appalachia.....	NA	NA	NA	<u>9/</u> 1.34
California.....	NA	NA	NA	NA
Northwest.....	1.95	1.70	1.52	<u>10/</u> 1.68

NA means Not Available

1/ Includes labor, containers, selling and overhead costs.

2/ Average custom packing and selling charges for tray packs were \$1.65 in Wenatchee-Okanogan, \$1.74 in Yakima, and \$1.67 in Idaho, Oregon, and Colorado.

3/ Average of all bags packed (10/4's, 12/3's, etc.). In the Appalachia area, this includes some 15/3's and 12/4's.

4/ Average custom packing and selling charges for bag cartons were \$1.27 in South Appalachia.

5/ Average custom packing and selling charges for bag cartons were \$1.55 in Wenatchee-Okanogan, \$1.63 in Yakima, and \$1.43 in Idaho, Oregon, and Colorado.

6/ Average custom packing and selling charges for bulk cartons were \$1.14 per carton in North Appalachia.

7/ Average custom packing and selling charges for bulk cartons were \$1.16 in Wenatchee-Okanogan, \$1.28 in Yakima, and Idaho, Oregon, and Colorado.

8/ Includes cell packs and overwraps but excludes other bulk containers and other miscellaneous containers.

9/ Average custom packing and selling charges for all containers were \$1.14 in North Appalachia.

10/ Average custom packing and selling charges for all containers were \$1.67 in Wenatchee-Okanogan, \$1.72 in Yakima, and \$1.56 in Idaho, Oregon, and Colorado.

Table 21--Methods of sale used by sample firms, five major production regions, 1969/70

Region and method of sale	High volume			Middle volume			Low volume			All sample firms
	third of sample firms	sample firms	sample firms	third of sample firms	sample firms	sample firms	third of sample firms	sample firms		
	<u>Percent</u>									
Northeast:										
f.o.b.	45.0	58.8	57.8	48.5						
Delivered	50.7	37.7	35.6	47.3						
Consignment and Auction	3.9	3.5	5.5	3.9						
Other methods	.4		1.1	.3						
Lake States:										
f.o.b.	41.7	64.2	62.1	47.9						
Delivered	56.4	34.5	35.8	50.3						
Consignment and Auction	1.9	1.3	2.1	1.8						
Other methods										
Appalachia:										
f.o.b.	51.0	74.5	79.4	56.7						
Delivered	44.5	22.8	18.0	39.2						
Consignment and Auction	4.5	2.7	2.6	4.1						
Other methods										
California:										
f.o.b.	N.A.	N.A.	N.A.	74.6						
Delivered	N.A.	N.A.	N.A.	20.9						
Consignment and Auction	N.A.	N.A.	N.A.	4.5						
Other methods										
Northwest:										
f.o.b.	90.6	92.7	95.9	91.5						
Delivered	3.6	2.5	.9	3.1						
Consignment and Auction	5.8	4.8	3.2	5.4						
Other methods										

N.A. means not available.

The ability of firms in the Northwest to nearly always sell apples on an f.o.b. basis is especially remarkable considering the long distance between the firms and their markets. The ability of firms in this region to do a good job in packing coupled with a quality product apparently results in favorable terms of sale.

Terms of sale for low- versus high-volume firms within each region differed the most in Appalachia but also in the Lake States, the Northeast, and to a lesser extent in the Northwest. Low-volume firms were able to sell a higher percentage of their volume on an f.o.b. basis compared with high-volume firms. High-volume firms were more apt to make delivered sales. In Appalachia, the low-volume firms sold 18 percent of their apples on a delivered basis, compared with 44 percent for high-volume firms.

TYPE OF BUYER

Managers of sample firms were asked to indicate the various market outlets for their fresh apple sales. Chainstores were by far the most common sales outlet, accounting for 54.2 percent of the volume nationally--34.9 percent was sold directly and 19.3 percent was sold through brokers (table 22). Volume sold directly to chainstores ranged from 28 percent for firms in the Northwest to 52 percent for firms in the Northeast. Generally, the high-volume firms made a larger percentage of direct sales to chainstores than did low-volume firms, which tended to sell to chainstores through a broker. The percentage of sales to chainstores through a broker was lowest in the Northeast, only 6.7 percent, and highest in California, nearly 31 percent.

Sales to wholesale terminal firms were 21.3 percent nationally, ranging from almost 24 percent in the Northeast and Northwest to only 12 percent in the Lake States. In the Northeast and California, the smaller packers sold a greater portion of their apples to wholesale terminal firms than did the larger firms, but the reverse was the case in the Lake States, Appalachia, and the Northwest.

From 4 to nearly 20 percent of the apples packed by sample firms went to brokers representing customers other than chainstores. Such sales were less than 10 percent of the packed volume in California, the Northeast, and the Lake States; over 10 percent in Appalachia; and nearly 20 percent in the Northwest. Except for firms in Appalachia, low-volume firms in a region sold a greater portion of their volume through brokers than did high-volume firms in the same region.

Exports accounted for 4.3 percent of the total sales and were heaviest in Appalachia and the Northwest. Truck jobbers and local retailers purchased minor amounts of apples in all regions. Other types of outlets, including military and school lunch purchases, accounted for 4.0 percent of the apple sales nationally.

Table 22-Distribution of fresh apple sales among various buyers, five major production regions, 1969/70

Type of buyer	High-volume third of sample firms	Middle-volume third of sample firms	Low-volume third of sample firms	Average
<u>Percent</u>				
Northeast:				
Chainstores--direct.....	52.1	55.5	43.4	52.3
Chainstores thru broker.....	6.8	5.9	9.7	6.7
Wholesale terminal firms.....	22.8	25.9	29.5	23.7
Brokers.....	5.5	6.1	8.8	5.8
Truck jobbers.....	1.6	1.7	4.5	1.8
Local retail.....	.9	.5	.7	.8
Export.....	3.1	4.0	2.5	3.3
Other.....	7.2	.4	.9	5.6
Total.....	100.0	100.0	100.0	100.0
Lake States:				
Chainstores--direct.....	51.2	46.0	44.2	49.8
Chainstores thru broker.....	21.2	15.0	23.6	20.1
Wholesale terminal firms.....	12.1	12.2	11.2	12.1
Brokers.....	6.9	8.2	10.5	7.3
Truck jobbers.....	2.6	6.0	4.9	3.4
Local retail.....	NA	NA	NA	1.7
Export.....	NA	NA	NA	1.1
Other.....	NA	NA	NA	4.5
Total.....	100.0	100.0	100.0	100.0
Appalachia:				
Chainstores--direct.....	42.4	37.1	42.4	41.6
Chainstores thru broker.....	14.3	22.0	20.2	15.8
Wholesale terminal firms.....	17.2	14.8	13.3	16.6
Brokers.....	12.3	11.1	9.7	11.9
Truck jobbers.....	1.9	4.4	6.2	2.6
Local retail.....	1.1	1.0	1.9	1.1
Exports.....	5.1	4.2	4.3	4.9
Other.....	5.7	5.4	2.0	5.5
Total.....	100.0	100.0	100.0	100.0
California:				
Chainstores--direct.....	35.4	41.2	31.0	36.9
Chainstores thru broker.....	32.4	27.9	30.8	30.9
Wholesale terminal firms.....	15.1	14.5	22.9	15.5
Brokers.....	NA	NA	NA	4.4
Truck jobbers.....	NA	NA	NA	.4
Local retail.....	NA	NA	NA	.4
Exports.....	NA	NA	NA	2.2
Other.....	NA	NA	NA	9.3
Total.....	100.0	100.0	100.0	100.0
Northwest:				
Chainstores--direct.....	30.8	20.6	19.9	28.1
Chainstores thru broker.....	20.3	24.9	29.0	21.7
Wholesale terminal firms.....	24.0	23.9	20.4	23.7
Brokers.....	14.7	23.7	22.1	16.9
Truck jobbers.....	1.4	.8	1.3	1.3
Local retail.....	.5	.3	.4	.5
Export.....	4.9	4.1	4.7	4.8
Other.....	3.4	1.7	2.2	3.0
Total.....	100.0	100.0	100.0	100.0
Average, all regions <u>1</u> /:				
Chainstores--direct.....	36.9	29.4	27.7	34.9
Chainstores thru broker.....	18.2	22.0	25.7	19.3
Wholesale terminal firms.....	21.5	21.5	19.5	21.3
Brokers.....	12.4	17.7	17.4	13.7
Truck jobbers.....	1.6	1.8	2.5	1.8
Local retail.....	.7	.7	.7	.7
Export.....	4.3	3.8	4.2	4.3
Other.....	4.4	3.1	2.3	4.0
Total.....	100.0	100.0	100.0	100.0

NA means not available

1/ Weighted by volume, thirds determined within regions.

DISTRIBUTION OF SALES BY GEOGRAPHIC REGIONS

Most of the firms sold the bulk of their fresh apples within their own region or in adjacent consumption regions (table 23). This was especially true in California, where almost 86 percent of the apples were sold within the State. Two-thirds of the fresh apples packaged in the Lake States were marketed in that region. Firms in the Northeast sold nearly 60 percent of their output within the region. In Appalachia, nearly 32 percent of the apples were sold in Appalachia and 26 percent were marketed in the nearby South Atlantic States.

However, in the Northwest, over 94 percent of the fresh apples were sold outside the region according to the sample firms. The Northwest marketed apples in every other region of the country, with 20 percent going to California and 9 to a little over 14 percent going to each of five other regions (Northeast, South Atlantic, Lake States, Other North Central, and West South Central).

In all major production regions, there was very little difference in geographic distribution patterns among large, medium, and small firms.

RETURNS TO GROWERS

On-tree returns to grower-packer firms were approximated by deducting harvesting, storage, packing, and selling costs from f.o.b. shipping point prices for selected weeks in the 1969/70 marketing year. The analysis considered such costs and prices for:

- (1) Red Delicious apples packed in New York, Michigan, and Appalachia in tray cartons and in master containers holding 12 3-pound bags.
- (2) Golden Delicious apples packed in Appalachia and the Northwest in tray cartons.
- (3) Jonathan apples packed in Michigan in master containers holding 12 3-pound bags.
- (4) McIntosh apples packed in Michigan and New York in master containers holding 12 3-pound bags.

Results of the analysis are presented in tables 24 and 25. Although data for more extended time periods might have resulted in a different pattern of returns, the approximations indicate that: (1) returns to growers were higher for apples marketed before the regular atmosphere storage season begins than they were for apples marketed during the RA storage season; (2) returns to growers were higher for apples in controlled atmosphere storage than for RA-stored apples, which is consistent with the fact that CA-storage capacity has been rapidly increasing in recent years, indicating that returns on fruit in CA

storage have been favorable to apple growers and packers; (3) returns to growers on Red Delicious of similar quality and size and packed in similar cartons were about equal for different production areas; (4) returns to growers on Red Delicious and Golden Delicious in the Northwest were comparable; and (5) returns to growers on Red and Golden Delicious were higher than for Jonathans and McIntosh.

Table 23--Distribution of fresh apples among geographic areas, five major production regions, 1969/70 1/

Region and distribution :	High-volume third of sample firms :	Middle-volume third of sample firms :	Low-volume third of sample firms :	All sample firms :
	<u>Percent</u>			
Northeast:				
Northeast.....:	58.1	64.0	58.4	59.5
Appalachia.....:	18.2	11.5	10.7	16.7
South Atlantic.....:	11.1	7.9	8.9	10.3
Lake States.....:	7.3	8.7	9.0	7.7
Other North Central States:	N.A.	N.A.	N.A.	.4
East South Central.....:	N.A.	N.A.	N.A.	.2
West South Central.....:	N.A.	----	N.A.	.1
Northwest.....:	----	----	----	----
California.....:	N.A.	N.A.	N.A.	2.0
Other Southwest.....:	----	----	----	----
Exports.....:	N.A.	N.A.	N.A.	3.3
Total.....:	100.0	100.0	100.0	100.0
Lake States:				
Northeast.....:	N.A.	N.A.	N.A.	.7
Appalachia.....:	N.A.	----	N.A.	.2
South Atlantic.....:	9.5	4.0	4.0	7.7
Lake States.....:	64.1	67.7	60.1	64.5
Other North Central States:	12.5	12.3	18.5	12.9
East South Central.....:	8.2	9.6	9.3	8.6
West South Central.....:	3.9	5.1	5.4	4.3
Northwest.....:				
California.....:				
Other Southwest.....:				
Exports.....:	N.A.	N.A.	N.A.	1.1
Total.....:	100.0	100.0	100.0	100.0
Appalachia:				
Northeast.....:	13.8	11.1	13.7	13.3
Appalachia.....:	31.6	34.4	25.8	31.7
South Atlantic.....:	24.5	30.0	32.1	26.0
Lake States.....:	9.2	7.3	8.7	8.8
Other North Central States:	1.9	1.4	2.5	1.8
East South Central.....:	8.1	7.9	7.9	8.1
West South Central.....:	5.8	3.7	5.0	5.4
Northwest.....:	----	----	----	----
California.....:	----	----	----	----
Other Southwest.....:	----	----	----	----
Exports.....:	5.1	4.2	4.3	4.9
Total.....:	100.0	100.0	100.0	100.0

See footnote at end of table.

--continued

Table 23--Distribution of fresh apples among geographic areas, five major production regions, 1969/70 1/ continued--

Region and distribution	High-volume third of sample firms	Middle-volume third of sample firms	Low-volume third of sample firms	All sample firms
	<u>Percent</u>			
California:				
Northeast.....				
Appalachia.....				
South Atlantic.....	N.A.		N.A.	.9
Lake States.....				
Other North Central States:		N.A.		.5
East South Central.....				
West South Central.....	N.A.			2.8
Northwest.....				.2
California.....	85.8	85.9	78.4	85.8
Other Southwest.....	N.A.		N.A.	7.6
Exports.....	N.A.	N.A.	N.A.	2.2
Total.....	100.0	100.0	100.0	100.0
Northwest:				
Northeast.....	11.0	12.2	7.8	11.0
Appalachia.....	3.9	5.3	5.0	4.2
South Atlantic.....	9.7	7.1	6.4	9.0
Lake States.....	15.0	13.5	13.1	14.6
Other North Central States:	13.2	7.7	7.3	11.7
East South Central.....	4.2	3.9	4.0	4.2
West South Central.....	11.1	12.2	12.0	11.3
Northwest.....	5.7	3.4	5.9	5.3
California.....	18.1	26.2	30.1	20.4
Other Southwest.....	3.2	4.4	3.7	3.5
Exports.....	4.9	4.1	4.7	4.8
Total.....	100.0	100.0	100.0	100.0

N.A. means not available.

1/ Northeast: New England, N.Y., and N.J.; Appalachia: Pa., W. Va., Va., Md., and Del.; South Atlantic: N.C., S.C., Ga., and Fla.; Lake States: Ohio, Mich., Ind., Ill., and Wis.; Other North Central: Minn., Iowa, Mo., Kan., Nebr., S. Dak., N. Dak.; East South Central: Ky., Tenn., Ala., Miss.; West South Central: Ark., La., Okla., Tex.; Northwest: Wash., Ore., Idaho, Mont., Wyo.; California; Other Southwest: Nev., Utah, Colo., N. Mex., and Ariz. Minor sales to Hawaii and Alaska are included under exports or in data for the Northwest and California.

Table 24--Returns to apple growers for Red Delicious apples, 3 selected weeks, 1969/70

Item	Week ended	F.o.b. shipping point price ^{1/}	Costs				Return to growers ^{2/}
			Harvesting	Storage	Packing and selling	Total	
<u>Dollars per carton</u>							
Tray packs:							
Northeast--							
Western and Central							
New York points, carton:							
tray pack, U.S. Fancy	Jan. 31, 1970	4.00	0.44	0.33	1.34	2.11	1.89
125's and larger	Apr. 4, 1970	<u>3/4.72</u>	.44	.64	1.34	2.42	2.30
Lake States--							
Western Michigan							
points, carton tray	Oct. 18, 1969	3.50	.43	0	1.17	1.60	1.90
pack, U.S. Fancy 125's	Jan. 31, 1970	3.38	.43	.29	1.17	1.89	1.49
and larger	Apr. 4, 1970	<u>3/4.62</u>	.43	.57	1.17	2.17	2.45
Appalachia--							
W. Va., Va., Md., Pa.,							
carton tray pack,							
combination U.S. Extra							
Fancy and U.S. Fancy	Oct. 18, 1969	3.82	.41	0	1.40	1.81	2.01
125's and larger	Jan. 31, 1970	3.55	.41	.30	1.40	2.11	1.44
Northwest, Yakima							
Valley, Wash.--							
Washington State grade,							
carton tray pack, Extra:							
Fancy 138's and larger,	Oct. 18, 1969	3.88	.34	0	1.61	1.95	1.93
mostly 125's and	Jan. 31, 1970	3.72	.34	.32	1.61	2.27	1.45
larger	Apr. 4, 1970	<u>3/4.88</u>	.34	.65	1.61	2.60	2.28
Bag, master containers:							
Northeast--							
Western and Central							
New York points, U.S.							
Fancy 2½ lb. and up,							
12-3 lb. film bags	Jan. 31, 1970	2.84	.44	.33	1.22	1.99	.85
master container	Apr. 4, 1970	<u>3/4.12</u>	.44	.64	1.22	2.30	1.82
Lake States--							
Western Michigan							
points, cartons U.S.							
Fancy 2½ lb. and up,	Oct. 18, 1969	3.14	.43	0	1.10	1.53	1.61
12-3 lb. film bags,	Jan. 31, 1970	2.75	.43	.29	1.10	1.82	.93
master container	Apr. 4, 1970	<u>3/4.00</u>	.43	.57	1.10	2.10	1.90
Appalachia--							
W. Va., Va., Md., Pa.,							
cartons, U.S. Fancy							
2½ lb. and up, 12-3 lb.							
film bags, master	Oct. 18, 1969	3.36	.41	0	1.32	1.73	1.63
container	Jan. 31, 1970	3.36	.41	.30	1.32	2.03	1.33

^{1/} Source: Weekly Summary of f.o.b. Prices, U.S. Dept. of Agr., Consumer and Mktg. Serv., Fruit and Vegetable Div., Market News Service.

^{2/} Derived by subtracting total costs from f.o.b. shipping point price. No allowances are made for promotion assessments or for storage losses.

^{3/} Controlled atmosphere.

Table 25--Returns to apple growers for Golden Delicious, Jonathan, and McIntosh apples, 3 selected weeks, 1969/70

Item	Week ended	F.o.b. shipping point price ^{1/}	Costs				Return to growers ^{2/}
			Harvesting	Storage	Packing and selling	Total	
<u>Dollars per carton</u>							
Golden Delicious:							
Tray packs--							
Appalachia:							
W. Va., Va., Md., Pa., carton tray pack, combination U.S. Extra Fancy and U.S. Fancy, 125's and larger	Oct. 18, 1969	3.81	0.41	0	1.40	1.81	2.00
	Jan. 31, 1970	3.12	.41	.30	1.40	2.11	1.01
Northwest:							
Yakima Valley, Wash. Washington State grade, carton tray pack, Extra Fancy 138's and larger, mostly 125's and larger							
	Oct. 18, 1969	3.92	.34	0	1.61	1.95	1.97
	Jan. 31, 1970	3.80	.34	.32	1.61	2.27	1.53
	Apr. 4, 1970	<u>3/4.95</u>	.34	.65	1.61	2.60	2.35
Jonathan:							
Bag, master containers-- Lake States:							
Western Michigan points, cartons U.S. Fancy, 2½ lb. and up, 12-3 lb. film bags, master container							
	Oct. 18, 1969	2.50	.43	0	1.10	1.53	.97
	Jan. 31, 1970	2.50	.43	.29	1.10	1.82	.68
	Apr. 4, 1970	<u>3/3.25</u>	.43	.57	1.10	2.10	1.15
McIntosh:							
Bag, master containers-- Northeast:							
Western and Central New York points, U.S. Fancy 2½ lb. and up, 12-3 lb. film bags, master container							
	Jan. 31, 1970	2.73	.44	.33	1.22	1.99	.74
	Apr. 4, 1970	<u>3/3.30</u>	.44	.64	1.22	2.30	1.00
Lake States:							
Western Michigan points, cartons U.S. Fancy 2½ lb. and up, 12-3 lb. film bags, master container							
	Oct. 18, 1969	2.50	.43	0	1.10	1.53	.97
	Jan. 31, 1970	2.65	.43	.29	1.10	1.82	.83
	Apr. 4, 1970	<u>3/3.25</u>	.43	.57	1.10	2.10	1.15

^{1/} Source: Weekly Summary of f.o.b. Prices, U.S. Dept. of Agr., Consumer and Mktg. Serv., Fruit and Vegetable Div., Market News Service.

^{2/} Derived by subtracting total costs from f.o.b. shipping point price. No allowances are made for promotion assessments or for storage losses.

^{3/} Controlled atmosphere.

APPENDIX

Selection of Sample

Lists of grower-packers and packer-shippers and the estimated volume of apples they handled were compiled from fruit and vegetable credit rating sources and from information furnished by industry organizations. Ten U.S. production regions were then delineated to meet the following conditions: (1) No two major production areas would be included in the same region; (2) the number of regions defined would be manageable for research purposes; and (3) consumption regions would fall within the boundaries of major areas classified by the Bureau of the Census and the U.S. Department of Agriculture's Crop Reporting Board. The regions are as follows:

1. Northeast: Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, and New Jersey.
2. Appalachia: Pennsylvania, West Virginia, Virginia, Maryland, and Delaware.
3. South Atlantic: North Carolina, South Carolina, Georgia, and Florida.
4. Lake States: Ohio, Michigan, Indiana, Illinois, and Wisconsin.
5. Other North Central States: Minnesota, Iowa, Missouri, Kansas, Nebraska, South Dakota, and North Dakota.
6. Eastern South Central States: Kentucky, Tennessee, Alabama, and Mississippi.
7. Western South Central States: Arkansas, Louisiana, Oklahoma, and Texas.
8. Northwest: Washington, Oregon, Idaho, Montana, and Wyoming.
9. California.
10. Other Southwest States: Nevada, Utah, Colorado, New Mexico, and Arizona.

Regions 1, 2, 4, 8, and 9 represent major apple production and consumption regions. Regions 3, 5, 6, 7, and 10 are primarily consumption regions, although in several instances important apple production centers are included within the region.

In the five major production regions, 317 firms were thought to be packing 100,000 cartons or more of fresh apples annually (app. table 1). Of these, 286 were initially selected for the sample. In addition, a few firms thought to be packing less than 100,000 cartons were included to provide a broader data base.

Appendix table 1--Number of firms packing apples, by estimated volume, sampling rate, and number of useable schedules by actual volume packed, 1969/70

Region and estimated volume	Number of known firms	Sampling rate	Number of useable schedules by actual volume
	<u>Number</u>	<u>Percent</u>	<u>Number</u>
Northeast:			
>200,000	21	100	7
100,000-200,000	24	50	15
<100,000	188	0	7
Lake States:			
>200,000	16	100	4
100,000-200,000	36	25	10
<100,000	226	0	19
Appalachia:			
>200,000	28	100	14
100,000-200,000	58	25	21
<100,000	170	0	26
Northwest:			
>500,000	26	100	20
>300,000-500,000	29	50	18
>200,000-300,000	23	33.3	17
>100,000-200,000	40	25	26
<100,000	73	0	8
California:			
>100,000	16	100	9
<100,000	18	0	7

Appendix table 2--Fresh apple pack of sample firms as a percentage of total fresh apple sales, 1969/70

Region	Total U.S. fresh sales <u>1/</u>	Total fresh pack, : sample firms	Sample firms volume : as a percentage of total
	Million Pounds		Percent
Northeast.....	610.0	226.9	37.2
Appalachia.....	729.6	253.1	34.7
Central (Lake States & Other North Central)			
Lake States--			
Michigan.....	247.0	116.6	47.2
Other Lake States.....	443.5	50.2	11.3
Other North Central.....			
Total Central.....	690.5	166.8	24.2
Western:			
Except California.....	1,540.6	1,106.8	71.8
California.....	130.0	74.2	57.1
Total.....	3,700.7	1,827.8	49.4

1/ Source: Fruits, Noncitrus, Revised Estimates, 1964-70, U.S. Dept. of Agr., Stat. Rptg. Serv., SRS Statistical Bulletin 505, Jan. 1973.

Of a total of 232 usable interview schedules, 67 were for firms packing less than 100,000 cartons of fresh apples annually.

Based on total fresh sales, the sample firms packed from 26 percent of the fresh volume in the Lake States to over 70 percent of the volume in the Northwest (app. table 2). It was estimated that the 232 sample firms packed 49 percent of the total U.S. pack of fresh apples in the 1969/70 season.

Importance of Apples in Packer Operations

For 185 of the 232 sample firms, apple packing operations accounted for 60 percent or more of their total operations (app. table 3). Firms in the Northeast and California were the most specialized. Apple packing constituted over 90 percent of total operations in 10 of the 16 California firms and in 20 of the 33 firms in the Northeast region. Firms in the Lake States and in the Northwest were more diversified, with apple packing accounting for less than 60 percent of total operations in approximately one of four sample firms in each region.

Appendix table 3--Importance of apples in total operations, sample firms, 1969/70

Region	Total sample	Apple packing as a percentage of total operations			
		60 percent and less	61 to 90 percent	Over 90 percent	No response
		<u>Number of sample firms</u>			
Northeast.....	33	4	8	20	1
Lake States....	33	9	13	11	0
Appalachia....	61	5	21	34	1
Northwest.....	89	22	29	37	1
California....	16	3	2	10	1
All regions..	232	43	73	112	4

Varieties of Apples Packed by Sample Firms

The apple varieties packed by the sample firms reflected the general production pattern for each area. Red Delicious were dominant in all regions and

areas, except in the Lake States and the Northeast (app. table 4). Red Delicious comprised one-third of the volume packed in Appalachia and about two-thirds of the volume packed in Wenatchee-Okanogan, Wash.

In the Lake States, Jonathans and Red Delicious were of about equal importance, accounting for about 30 percent of the volume packed. In the Northeast, McIntosh was by far the most important variety--comprising about 55 percent of the volume.

Appendix table 4--Varieties of apples packed by sample firms, 1969/70

Apple variety	North- east			Appalachia			Northwest			All and Colo.	California
	Lake States	North	South	North	South	All	Wenatchee- Okanogan	Yakima	Northwest		
	<u>Percent</u>										
Red Delicious.....	18.7	28.0	31.5	51.0	34.7	34.7	66.8	53.7	49.3	59.5	50.3
Golden Delicious.....	4.6	7.0	11.0	15.0	11.7	11.7	22.8	28.6	8.3	23.5	9.9
McIntosh.....	55.3	16.4	.9	.8	.8	.8					.4
Rome Beauty.....	9.5	5.9	17.0	12.9	16.3	16.3	.6	2.0	11.0	2.3	.5
Winesap.....	.2	1.7	6.2	.7	5.3	5.3	6.8	9.8		7.3	
Jonathan.....	.1	29.7	4.1	2.1	3.8	3.8	.5	.3	6.7	1.1	2.8
Yellow Newtowns.....											23.8
Gravenstein.....											10.5
Others.....	11.6	11.3	29.3	18.3	27.4	27.4	2.5	5.6	24.7	6.3	1.8
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Appendix table 5--Total fresh apple storage holdings, by region, 1962/63-1972/73

Season	Eastern		Central		Western		Eastern		Central		Western	
	Dec. 1	May 1	Dec. 1	May 1	Dec. 1	May 1	Dec. 1	May 1	Dec. 1	May 1	Dec. 1	May 1
	1,000 bushels											
1962/63	20,344	1,526	6,075	339	18,108	4,047	45.7	25.8	13.6	5.7	40.7	68.5
1963/64	18,529	1,624	6,130	563	24,516	3,965	37.7	26.4	12.5	9.2	49.8	64.4
1964/65	21,255	2,257	7,851	566	19,632	5,335	43.6	27.7	16.1	6.9	40.3	65.4
1965/66	23,427	2,066	7,477	583	19,372	3,973	46.6	31.2	14.9	8.8	38.5	60.0
1966/67	16,234	1,335	6,810	578	25,450	6,259	33.5	16.3	14.0	7.1	52.5	76.6
	1,000 Pounds											
1967/68	798,688	62,453	239,092	7,879	958,548	211,000	40.0	22.2	12.0	2.8	48.0	75.0
1968/69	828,260	77,456	303,609	14,298	848,110	222,643	41.9	24.6	15.3	4.6	42.8	70.8
1969/70	991,588	108,394	381,040	28,754	1,427,340	309,306	35.4	24.3	13.6	6.4	51.0	69.3
1970/71	935,112	96,149	361,470	30,362	1,160,714	342,918	38.1	20.5	14.7	6.5	47.2	73.0
1971/72	1,070,430	121,935	371,886	27,266	1,112,803	327,918	41.9	25.6	14.6	5.7	43.5	68.7
1972/73	767,062		342,109		1,111,765		34.5		15.4		50.1	

Source: Summary of Regional Cold Storage Holdings, 1962-72, U. S. Dept. of Agr., Stat. Rptg. Serv.

Appendix table 6--Quality distribution of tree-run fresh apples, five major production regions, 1969/70

Region	U.S. No. 1 or better	Utilities	Culls	Combination utilities and culls	Total
	<u>Percent</u>				
Northeast.....	79.6	13.5	6.9	--	100.0
Lake States.....	65.2	24.5	10.3	--	100.0
Appalachia:					
North Appalachia.....	68.4	23.0	8.6	--	100.0
South Appalachia.....	73.7	15.8	10.5	--	100.0
All Appalachia.....	68.7	21.4	9.9	--	100.0
California:					
North of San Francisco...	40.3	--	--	59.7	100.0
South of San Francisco...	62.1	--	--	37.9	100.0
All California.....	52.3	--	--	47.7	100.0
Northwest:					
Wenatchee-Okanogan.....	80.5	--	--	19.5	100.0
Yakima.....	80.2	--	--	19.8	100.0
Idaho-Oregon-Colorado....	69.2	--	--	30.8	100.0
All Northwest.....	79.1	--	--	20.9	100.0

Appendix table 7--Regression of labor costs per carton on volume, quality, and varietal variables

Region or area	Constant term	B coefficient with respect to 1/		R ²	N
		Volume per season	U.S. No. 1 or better			Soft varieties 2/ Percent
		1,000 cartons	Percent	Percent	
Northeast.....	0.55180	0.00002 (.26806)	-0.24726 (1.09432)	-0.01856 (.08455)	.07
North Appalachia.....	.54462	.00027 (.88866)	-.16068 (1.11879)	-.34749 (1.12388)	.15
Lake States.....	.44069	-.00024 (1.57798)	-.10997 (0.51029)	.16309 (1.05924)	.27
Wenatchee.....	.49739	-.00012 (.54273)	<u>3/</u> -.88968 (2.03713)	.52156 (1.18861)	.29
Yakima.....	.21505	-.00003 (.34107)	.05770 (.24687)	.69132** (4.10821)	.69
All Northwest.....	.49062	-.00007 (.81414)	-.07267 (.34468)	.30107 (1.43278)	.08

** Statistically significant at 1-percent level.

1/ t-ratios in parentheses.

2/ Golden Delicious and McIntosh

3/ Statistically significant at 10-percent level.

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